Designation: F 1509 – 94 (Reapproved 2004)

Standard Test Methods for Determining Acceptability of Ribbon Welds in Fabric Cartridges[1]

This standard is issued under the fixed designation F 1509; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 These test methods are for evaluating ribbon welds in fabric cartridges that do not contain endless woven loops. These test methods apply to ribbon welds made with ultrasonic energy but do not cover special-purpose welds such as overlap or butt welds. Physical characteristics of ribbon welds and test performance may be used to predict acceptable function and printing life of the weld in the finished cartridge. These test methods are suitable both for comparative evaluations by end-users and for manufacturing control within the ribbon product industry.

1.2 Since types of ribbon welds and equipment vary, similar fabric cartridges may not contain the same type of ribbon weld. Any evaluation comparing products from different sources should note this.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:* [2]

F 1174 Practice for Using a Personal Computer as a Test Instrument

3. Terminology

3.1 *Definition*

3.1.1 *hot spotting*—printed images produced with an inked fabric ribbon where occasional individual images are darker than those around them; this condition occurs when the amount of ink is not consistent throughout the fabric ribbon.

4. Summary of Test Methods

4.1 Fabric ribbon welds can be evaluated on the basis of the following characteristics:

4.1.1 Appearance,
4.1.2 Width,
4.1.3 Alignment,
4.1.4 Strength,
4.1.5 Printability, and
4.1.6 Durability.

4.2 Test methods for evaluating welds in these areas are described. These test methods are divided into sections by ribbon weld characteristic. Each section consists of a test procedure, results that can be obtained, and what these results may indicate. Each user must determine the tests that are reasonable considering the needs and the equipment available.

5. Significance and Use

5.1 The test methods described can be used to evaluate acceptability of fabric ribbon welds on a comparative basis. Some, though not all, tests may also be used for manufacturing control. The weld durability test is exclusively for manufacturing control, since it involves in-process testing.

5.2 Users may choose to perform any or all of the tests described, depending upon results desired and equipment available.

6. Interferences

6.1 Interferences that may impact test results are listed for each test method to which they apply.

6.2 *Weld Width*—Weld width is best determined with the use of polarized light, due to the difference between filament deformation and physical property changes (that is, melting).

6.3 *Weld Strength*:

6.3.1 The type of welding equipment used and operator technique may cause variability in weld strength. For weld equipment that does not automatically tension the fabric, the tension applied by the operator when securing the fabric in the fixture can significantly alter the weld strength.

6.3.2 The type of nylon, thickness, style, finishing, and slitting of the fabric may cause variability in weld strength. Ink properties and level of inking of the fabric also contribute to

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[1] These test methods are under the jurisdiction of ASTM Committee F05 on Business Imaging Products and are the direct responsibility of Subcommittee F05.02 on Inked Transfer Imaging Products.

Current edition approved Dec. 1, 2004. Published December 2004. Originally approved in 1994. Last previous edition approved in 2000 as F 1509 – 94 (2000).

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

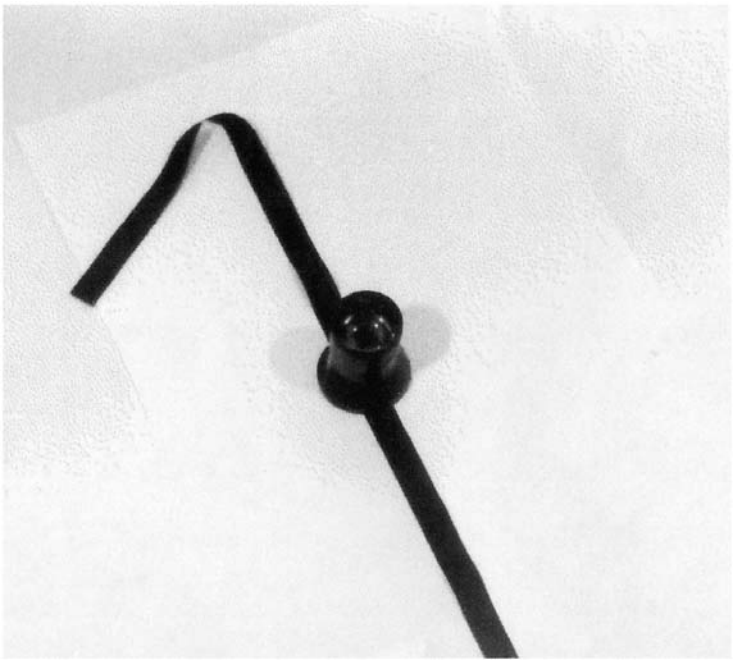

FIG. 1 Hand Held Comparator

variability in optimum weld strength. Such ink characteristics as oil color carriers, type of solids, if present, and quality of dispersion may be considered. Samples being compared should be classified as closely as possible and tested under equal conditions.

6.4 *Weld Printability*:

6.4.1 Certain types of ribbon welds may cause print defects peculiar to the type of weld. Some welds are not designed to be overprintable.

6.4.2 Some types of ink formulations and nylon types will be more prone to hotspotting than others. Hotspotting at the weld could, therefore, be a function of the material rather than the welding process. Note evidence of hotspotting elsewhere in printout.

6.5 *Weld Durability*:

6.5.1 The zipper test may not produce meaningful results when welding certain special-application fabrics (that is, twill fabric that does not have a regular weave pattern).

6.5.2 Any short loop length and equivalent end of life can be calculated for a product. However, some cartridge designs will not function properly with radically reduced amounts of nylon.

6.5.3 Certain cartridge internal designs can induce more wear on a ribbon weld. Any comparative testing of ribbon welds should use the same design.

6.5.4 Different prints (even of the same model), impact adjustments, and print modes will cause variability in amount of weld wear.

7. Test Methods

7.1 *Weld Appearance*:

7.1.1 *Apparatus—Hand-held Comparator*[3] *and Contrasting Paper*, for ease in viewing sample.

7.1.2 Advance the ribbon in a finished cartridge until the ribbon weld is outside the cartridge. Place the ribbon on a flat surface and view the weld with a hand-held comparator. See Fig. 1.

7.1.3 Examine the weld for surface smoothness and uniformity. Note glazed or melted appearance that may indicate a brittle, weaker weld. Examine ribbon edges adjacent to the weld for fraying or extraneous fibers (“tails”) produced by the welding process.

7.2 *Weld Alignment*:

7.2.1 *Apparatus*—See 7.1.1.

7.2.2 Weld alignment is the result of tolerances on ribbon slit width and physical alignment.

7.2.3 Examine the edges of the ribbon weld for proper alignment using hand-held comparator, as shown in Fig. 2. Position zero crosshair of printed scale at outer edge of the nylon. Measurement is taken to the inner edge. Amount of offset at Position A1 is added to the amount of offset at Position A2 for the total misalignment.

7.2.4 Amount of misalignment to be allowed shall be determined by the overall width of the nylon being welded and by product application.

[3] The sole source of supply of the apparatus known to the committee at this time is Bishop Graphics, P.O. Box 6012, Agonra Hills, CA 91376-6012. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee [1], which you may attend.

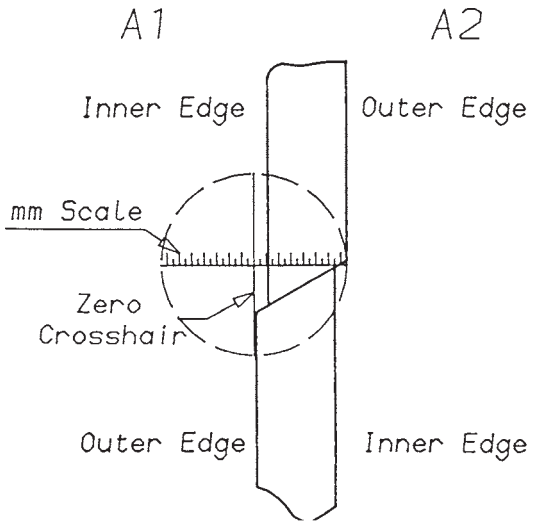

FIG. 2 Weld Misalignment

7.2.5 Note the direction of the offset edge. Offset edges may present an exposed acute angle in relation to the direction in which the nylon feeds through the printer and the cartridge drive system. This situation is shown in Fig. 3(B). There is a potential problem of fabric edges catching in the printhead or the cartridge drive gears during use.

7.3 *Weld Width*:

7.3.1 *Apparatus*—See 7.1.1.

7.3.2 Measure edge to edge width of the ribbon weld using a hand-held comparator. See Fig. 4. Position zero crosshair of the printed scale at the outer edge of the weld. Measurement is taken across the weld as shown.

7.3.3 The width of the weld may influence durability, depending upon the application. In some cases, narrow welds may be prone to fracture during use. Width data may be of importance if comparing different types of welds in products designated for use on the same printer models.

7.4 *Weld Strength*:

7.4.1 *Apparatus—Tension Gage*[3,4], mounted on stand with cam clamps for securing ribbon ends.

7.4.2 To determine weld break strength, cut an 8-in. sample piece of nylon (4 in. of nylon on either side of the weld). Clamp ends of sample nylon in the tension gage as shown in Fig. 5. Pull down the lever arm at a slow and steady rate until weld breaks apart. Read the maximum measurement on the dial.

7.4.3 Equipment is available for tension testing that is motor driven and does not require manual operation of a lever arm. Testers of the constant-rate-of-extension type that produce a digital display and a load elongation curve may be used. Refer to the manufacturers' instructions for the appropriate method.

7.4.4 Weld strength data may be used for comparison purposes and to see variability patterns, recognizing that excess break strength may indicate a weld that is beyond the optimum range and will fracture sooner. Tensile strength measurements alone may be an unreliable indicator of impact strength.

7.5 *Weld Printability*:

7.5.1 *Apparatus—Printer Models*, appropriate for product under evaluation.

7.5.2 Using applicable printer model, install the finished cartridge and run a self-test or suitable computer-generated print pattern. Refer to Practice F 1174. Run the test for a sufficient time period to note any function problems caused by the ribbon weld.

7.5.3 Observe the number of pages printed before the weld passes the printhead. On some printers, it is possible to see the weld as the fabric passes from the exit side of the cartridge over to the drive side entrance. This is not possible on products where the opening between the cartridge arms is narrow or when the printer design hides the ribbon from view.

7.5.3.1 When it is not possible to actually see the ribbon weld during printing, carefully examine the initial pages of printout until the first weld marks in the print are found. Look for voids within characters caused by the pins not penetrating the weld. Note smears or hotspotting caused by extraneous fibers that have absorbed ink. Using this page interval, examine the printout for print defects.

7.6 *Weld Durability*:

7.6.1 *Apparatus—Printer Models*, appropriate for product under evaluation. Use ultrasonic welding equipment and specific fixtures for nylon being evaluated.

7.6.2 One measure that may be used in manufacturing to predict weld durability is a "zipper" test to determine that welding equipment is properly adjusted to produce an optimum weld. The welding operation is interrupted after the first weld. The test is performed before the second weld, or "ironing" operation. The first weld is manually delaminated, separating the layers by tearing from one side to the center and then from the opposite side to the center. Listen for a sound like a zipper opening. Look for filament fracture only and no torn fabric where the nylon was welded. Lack of zipper separation and sound usually indicates that the fabric has been torn and a weld set-up will not produce a durable weld.

7.6.3 Short loop printer testing may be performed to verify weld durability. Some proportion of the standard quantity of nylon in the finished cartridge is calculated, as shown in Table 1. The proportional run time versus the standard length time is determined for the printer test. The shorter length of nylon is assembled in a cartridge and welded. The cartridge is installed

TABLE 1 Standard Print Test Versus Short Loop

Example:	
66 lines/page × 132 characters/line = 8700 characters/page	
Standard Print Test:	
Printer speed	150 CPS
Standard ribbon length	10 yd (9.15 m)
Ribbon width	½ in. (12.7 mm)
Character yield	2 000 000
Print test to end of life	3 h, 42 min
Pages	230
Short-Loop Print Test:	
Loop length (1/20 of standard)	18 in. (0.46 m)
Character yield	100 000
Print test to end of life	11 min
Pages	11.5

[4] The sole source of supply of the tension gage known to the committee at this time is John Chatillon & Sons, Force Measurement Division, P.O. Box 35668, Greensboro, NC 27425-5668.

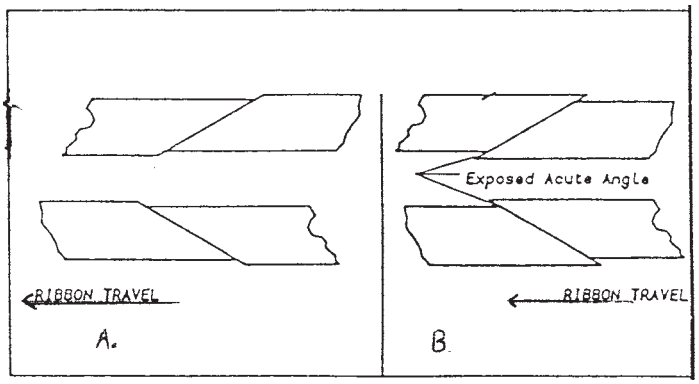

FIG. 3 Angle of Offset

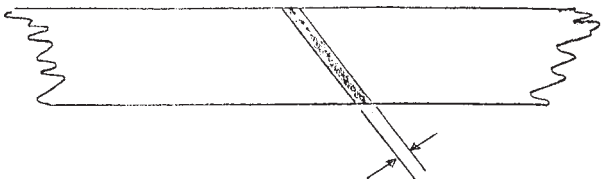

FIG. 4 Weld Width

on an applicable printer and run for the calculated time. Multiple welds may be used in the short loop to obtain more information.

7.6.4 At the end of the printer test, the weld is examined visually for fraying, holes, peeling, etc. Agreed values may be determined experimentally within the manufacturing facility to evaluate the results of testing. Fabric welds may also be examined at specific points during the shorter loop printer test to estimate wear at various character levels.

8. Report

8.1 Report the following information:

8.1.1 Identify different categories or products being tested.

8.1.2 Record details such as fabric tested, ink identification and level of inking, method of manufacture, equipment used, etc.

8.2 *Weld Appearance*— Record detailed description of findings for each sample.

8.3 *Weld Alignment and Weld Width*—For width and alignment, report actual measurements for each sample and range of sample measurements. Comparisons may be made to predetermined limits or between sets of samples tested.

8.4 *Weld Strength*— For break strength test, report measurements for each sample. Ranges or other measurements of dispersion should be calculated in order to make comparisons.

8.5 *Weld Printability*—For the printability test, report descriptions of any print defects related to the weld. A sample of print may be included, as determined by the user.

8.6 *Weld Durability*:

8.6.1 For the zipper test, report results as either "acceptable" or "unacceptable." Describe the unacceptable condition in detail for use in corrective action.

8.6.2 For the short-loop durability test, record the length of fabric loop tested and number of characters run plus test equivalent of life. Report any damage to the weld and any corresponding print defects found. In the comparison of products, establish a ranking order based on the agreed-upon values for the product application. An example of one type of ranking chart appears in Table 2.

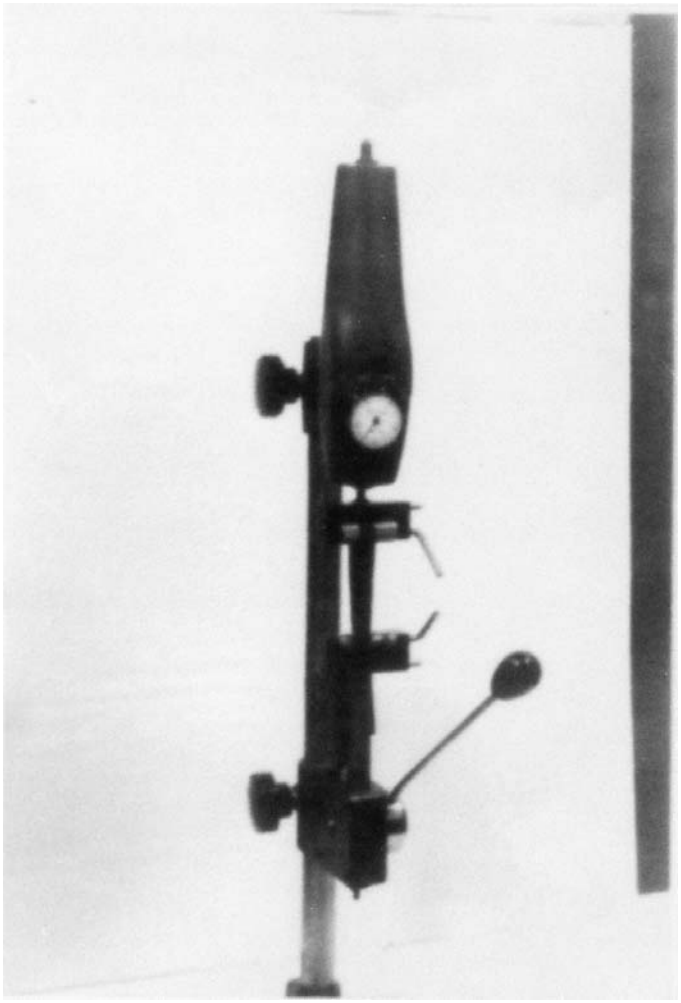

FIG. 5 Chatillon Tension Gage

9. Precision and Bias

9.1 *Repeatability*— Within one laboratory, with a single operator employing the same methods and test equipment, under the same conditions, results are as follows.

TABLE 2 Weld Life Analysis Perception Value Rating

PVR No.[A]	Description
1	No visual effect
2	Filament fracture
3	One hole 3 mm or less
4	One hole > 3 mm < 4 mm
5	One hole > 4 mm < 6 mm
6	Worse than PVR No. 5
PVR No.[B]	Description
1	No visual effect
2	Filament fracture
3	One hole 3 mm or less
4	One hole > 3 mm < 6 mm
5	One hole > 6 mm < 10 mm
6	Worse than PVR No. 5

[A] This PVR is also used for ribbons greater than ½ in. and going into dot matrix printers.
[B] This PVR is used for ribbons greater than ½ in. in fully formed printers.

9.1.1 *Weld Alignment and Weld Width*—Repeated measurements on the same test specimens have been found to agree within 3.3 %.

9.1.2 *Weld Strength*— Because break strength is a destructive test, repeatability on the same specimen cannot be tested. However, the means of measured values from two groups of test specimens taken at random from one uniform lot of product have been found to agree within 5 %. The standard deviations of measured values from two groups of test specimens taken at random from one uniform lot of product have been found to agree within 1.3 %.

9.1.3 *Weld Printability and Weld Durability*—Where analysis of results is subjective, a ranking order is repeatable, provided evaluators are trained on in-house standards prior to testing and analysis.

9.2 *Reproducibility*— Test results may not be reproducible between laboratories due to differences in test equipment selected, laboratory conditions, and manufacturing methods. Internal predetermined standards for manufacturing control may also vary between facilities.

9.3 *Bias*—Since there are no accepted reference materials, bias cannot be determined.

10. Keywords

10.1 durability; fabric ribbon welds; impact printer; impact printer ribbon; strength